

CLAIMS

1. A circuit board producing method in executing, inside a processing chamber, a treatment of forming a thin-film on a to-be-processed target or a treatment of processing said thin-film formed on said to-be-processed target, comprising the steps of:

performing an irradiation with a laser light into said processing chamber through an observing window, said laser light having a desired polarization and a desired wavelength and being intensity-modulated with a desired frequency,

wavelength-separating and light-receiving a light of a wavelength component of said frequency out of backward scattered-lights that have been scattered by particles inside said processing chamber through said irradiation and that have passed through said observing window,

detecting said frequency component out of said light-received signal obtained by being light-received,

obtaining, using said detected signal, information about number and size of said particles existing in a region irradiated with said laser light inside said processing chamber, and

outputting said obtained information about said number and said size of said particles.

2. The circuit board producing method as claimed in Claim 1, further comprising the steps of:

wavelength-separating, light-receiving, and image-photographing said light of said wavelength component out of said backward scattered-lights that have been scattered by said particles inside said processing chamber and that have passed through said observing window,

detecting said frequency component out of said light-received signal obtained by being light-received, and

judging at least one of said number, said size, and distribution of said particles by using said detected signal obtained by being detected and said image obtained by being image-photographed.

3. The circuit board producing method as claimed in Claim 1, wherein said desired polarization of said laser light is P-polarized state, an irradiation with said P-polarized laser beam being performed into said processing chamber through said observing window that is inclined in such a manner as to form Brewster angle toward said P-polarized laser beam.

4. The circuit board producing method as claimed in Claim 1, wherein a 2-dimensional distribution of said particles is judged by executing a rotation scanning of said irradiating beam in a horizontal direction, said irradiation with said irradiating beam being performed into said processing chamber through said observing window.

5. The circuit board producing method as claimed

in Claim 1, wherein said desired frequency differs from a frequency of an exciting source and its integer-multiples, said exciting source being used for said thin-film forming treatment or said thin-film processing treatment.

6. A circuit board producing method, comprising the steps of:

applying a high-frequency voltage to electrodes inside a processing chamber in a state where a to-be-processed target has been transferred into said processing chamber, and generating plasma inside said processing chamber so as to process said to-be-processed target,

introducing a laser light into said processing chamber through an observing window so as to irradiate, with said laser light, a region directly over said to-be-processed target that is being processed by said plasma, said laser light being intensity-modulated with a desired frequency,

detecting scattered-lights that have been scattered by particles inside said processing chamber through said irradiation and that have passed through said observing window,

obtaining, from said detected scattered-lights, information about said particles existing in said region directly over said to-be-processed target, said region having been irradiated with said laser light, and

outputting said obtained information about said particles.

7. The circuit board producing method as claimed in Claim 6, wherein, from said scattered-lights that have passed through said observing window, a light of a wavelength component of said desired frequency is wavelength-separated and detected through a filter.

8. The circuit board producing method as claimed in Claim 6, further comprising a step of obtaining, from said detected scattered-lights, information about size and distribution of said particles existing in said region directly over said to-be-processed target.

9. A circuit board producing method, comprising the steps of:

generating plasma inside a processing chamber so as to process a to-be-processed target set inside said processing chamber,

introducing, in a middle of processing said to-be-processed target, a laser light into said processing chamber through an observing window so as to irradiate, with said laser light, a region directly over said to-be-processed target that is being processed by said plasma,

detecting scattered-lights in such a manner as to be separated from an emitted-light emitted from said plasma, said scattered-lights having been scattered by particles inside said processing chamber through said irradiation and having passed through said

observing window,

determining, from said detected scattered-lights, information about size and distribution of at least said particles existing in said region directly over said to-be-processed target, and

displaying, on a monitor screen, said determined information about said size and said distribution of said particles existing in said region directly over said to-be-processed target.

10. The circuit board producing method as claimed in Claim 9, wherein said scattered-lights are detected in such a manner as to be separated from a reflected-light reflected from a wall surface of said processing chamber, said scattered-lights having been scattered through said irradiation by said particles floating inside said processing chamber.

11. The circuit board producing method as claimed in Claim 9, wherein, while monitoring a contamination situation inside said processing chamber in accordance with said information about said size and said distribution of said particles, a treatment of forming a thin-film on said to-be-processed target or a treatment of processing said thin-film formed on said to-be-processed target is executed inside said processing chamber.

12. A circuit board producing apparatus, comprising:

irradiating means for performing an irradiation

tion with a light into a processing chamber used for performing a desired thin-film forming or thin-film processing treatment toward a to-be-processed target, said light having a desired polarization and being intensity-modulated with a desired frequency,

observing window means provided on a side wall of said processing chamber so as to guide said light from said irradiating means into said processing chamber,

means for substantially eliminating a reflected-light reflected from said observing window, means for reducing said reflected-light, or means for light-shielding said reflected-light,

scattered-light detecting means including means for wavelength-separating, from backward scattered-lights, and light-receiving only said desired wavelength component through said same observing window, said backward scattered-lights having been scattered by particles inside said processing chamber,

signal processing means for detecting said desired frequency component out of said light-received signal obtained by said scattered-light detecting means, and for judging at least number and size of said particles from said detected signal, and

outputting means for outputting said information obtained from said signal processing means.

13. The circuit board producing apparatus as claimed in Claim 12, wherein said scattered-light

detecting means includes image-photographing means for image-photographing said backward scattered-lights through said same observing window, said backward scattered-lights having been scattered by said particles inside said processing chamber, said signal processing means judging said number, said size, and distribution of said particles from image image-photographed by said image-photographing means and said detected signal of said frequency component.

14. The circuit board producing apparatus as claimed in Claim 12, wherein said observing window is subjected to an anti-reflection processing and is provided with a desired inclination.

15. The circuit board producing apparatus as claimed in Claim 14, wherein said desired polarization is P-polarized state, said inclination of said observing window being an inclination that forms Brewster angle toward said P-polarized incident beam.

16. The circuit board producing apparatus as claimed in Claim 12, wherein said irradiating means includes means for executing a rotation scanning of said irradiating beam in a horizontal direction, said irradiation with said irradiating beam being performed into said processing chamber through said observing window, said signal processing means making it possible to judge a 2-dimensional distribution of said particles.

17. The circuit board producing apparatus as

claimed in Claim 16, wherein said observing window is formed in a warped configuration.

18. The circuit board producing apparatus as claimed in Claim 12, wherein said scattered-light detecting means detects said scattered-lights scattered from said particles in such a manner as to be separated from a reflected-light reflected from a wall surface of said processing chamber.

19. The circuit board producing apparatus as claimed in Claim 12, wherein said outputting means outputs said information about said size and distribution of said particles detected inside said processing chamber.

20. A circuit board producing apparatus, comprising:

processing chamber means including a setting unit and an observing window unit, said setting unit setting a to-be-processed target inside,

plasma generating means for feeding a high-frequency voltage so as to generate plasma inside said processing chamber means,

laser light irradiating means for irradiating, with a scanning irradiation with a laser light, a region over said to-be-processed target through said observing window unit, said to-be-processed target being set in said setting unit inside said processing chamber, said laser light being intensity-modulated with a desired frequency differing from a frequency of

said high-frequency voltage,

scattered-light detecting means for detecting lights that have been scattered by particles through said laser light scanning irradiation by said laser light irradiating means and that have passed through said observing window, said particles floating inside said processing chamber,

particle information acquiring means for obtaining, from said scattered-lights detected by said detecting means, information about said particles existing in said region directly over said to-be-processed target, said region having been irradiated with said laser light, and

outputting means for outputting said information about said particles acquired by said particle information acquiring means.

21. The circuit board producing apparatus as claimed in Claim 20, wherein said laser light irradiating means irradiates, with said scanning irradiation with a P-polarized laser light, said region directly over said to-be-processed target through said observing window unit, said to-be-processed target being set in said setting unit inside said processing chamber.

22. The circuit board producing apparatus as claimed in Claim 20, wherein said observing window unit is subjected to an anti-reflection processing.

23. The circuit board producing apparatus as claimed in Claim 20, wherein said scattered-light

detecting means detects said scattered-lights scattered from said particles in such a manner that said scattered-lights are separated from an emitted-light in two regions of the wavelength and the frequency, said emitted-light being emitted from said plasma generated inside said processing chamber means.

24. The circuit board producing apparatus as claimed in Claim 20, wherein said scattered-light detecting means detects said scattered-lights scattered from said particles in such a manner that said scattered-lights are separated from a reflected-light reflected from a wall surface of said processing chamber means.

25. The circuit board producing apparatus as claimed in Claim 20, wherein said outputting means outputs said information about size and distribution of said particles detected inside said processing chamber.